How Dryness Levels were Developed in the 7-day Fire Potential Outlook

Historically, the fire community has defined fuel dryness in terms of percentile ranks of various NFDRS fuel moisture elements. In Nevada, this usually meant 80/95th or 90/97th percentile values of either BI or ERC. Using these thresholds is a legitimate way of assessing fuel dryness, but there is a weakness: there is no direct correlation with actual fire activity. A more useful result is obtained, we think, by using Fire Family Plus to determine threshold values by comparing various NFDRS indices with actual fire activity.

After months of comparing various NFDRS indices singly and in pairs to historical fire activity in the Western Great Basin, we found that a **combination of F100 and ERC** for fuel model G (ERC-G) had the highest statistical correlation with fire activity.

Here is a matrix of one of our results: F100 versus ERC-G values for Nevada PSA 6 (Humboldt Basin). This shows the average number of Fire Days over the last 18 years for each ERC and F100 value:

ERC

F100	<65	65	70	75	80	85	90	95	100	105	110	
2	0	0	0	0	0	0	0	1	0	2	1	4
3	0	0	0	0	0	1	1	11	16	7	0	36
4	0	0	0	2	7	12	42	31	18	0	0	112
5	0	6	5	6	10	18	23	11	4	0	0	83
6	2	5	4	5	10	13	8	0	0	0	0	47
7	5	1	3	3	7	5	1	0	0	0	0	25
8	3	3	5	8	2	1	0	0	0	0	0	22
9	4	1	4	8	1	0	0	0	0	0	0	18
10	3	2	3	3	1	0	0	0	0	0	0	12
11	2	0	3	1	0	0	0	0	0	0	0	6
>11	6	0	0	0	0	0	0	0	0	0	0	6
	25	18	27	36	38	50	75	54	38	9	1	371

In this example, there were a total of 371 Fire Days for the months of May through September. The highest number of fires occur when the ERC is 90 or above and F100 drops to 4 or lower. There are a few “stray” fires that occur in the green…at low ERCs and fairly high F100 values, but since all fires are counted…even single tree fires…this is to be expected.

We also created a matrix of Large Fire Days. Here's the one we made for PSA 6:

F100 \ ERC	<65	65	70	75	80	85	90	95	100	105	110	
2	0	0	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	1	1	2	2	4	0	10
4	0	0	0	0	1	1	10	9	1	0	0	22
5	0	0	0	1	2	3	3	3	2	0	0	14
6	0	1	0	0	1	2	1	0	0	0	0	5
7	1	1	0	1	0	0	0	0	0	0	0	3
8	0	0	2	2	0	0	0	0	0	0	0	4
9	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	1	0	0	0	0	0	0	0	1
>11	0	0	0	0	0	0	0	0	0	0	0	0
	1	2	2	5	4	7	15	14	5	4	0	59

Of the original 371 Fire Days, 59 of them were also Large Fire Days. When we compared numbers, the breakpoints came in at the same levels (ERC greater than 75 with F100 less than or equal to 6, and ERC greater than 90 and F100 less than or equal to 4) with even fewer stray fires.

Even though the matrix shows us that most large fires in PSA 6 occur in the red zone (when ERC goes above 90 and F100 drops below 4), it doesn't guarantee that a fire will happen on any day that meets those criteria. A "red" day only says that most instances of large fires occurred when the fuels were at least that dry. **In addition to fuels dryness, an ignition source is needed**: lightning, human-caused or possibly a holdover from an old start kicked up by strong winds. And even then, development into a large fire will depend on wind, terrain and continuity of fuels.

In reality, a "red" day combined with an ignition only has about a 20% chance of producing a large fire.

This is the way the actual statistics worked out **for PSA 6: given any fire start, the chance that it will turn into a large fire is 8% for a "green" (moist) day, 17% for a "yellow" (dry) day, and 22% for a "red" (very dry) day.**

These numbers don't look very impressive. But you should also consider that historically, **half (49%) of all large fires occurred on "red" days, and only 15% of all large fires occurred on "green" days**. Even with low percentage probabilities for any individual day, the color divisions provide us with very important information.

Dryness Levels

To simplify our Fire Potential Outlook, we took the combination of ERC and F100 and created Dryness Levels (DL). The DL is portrayed as green, yellow or brown representing moist, dry or very dry conditions, respectively.

Each day during the fire season we make a forecast of Dryness Level for each PSA for the next 7 days. This is posted to the NWCC web page as part of the **7-Day Significant Fire Potential** product. **When an area dries enough to move into the brown and has an ignition source (lightning, strong winds to blow over power lines or to stir up a holdover, or a human start), that day has about a 20% chance of developing a large fire.**

Thoughts Regarding Fuel Dryness

High values of ERC and low 100-hour fuel moistures are well correlated with fire activity in Nevada. Combining them brings another benefit: by including F100, we are essentially adding more weight to lighter fuels than what would be present by using ERC by itself. **The ERC is heavily weighted toward fuel moistures of large fuels (F1000) and therefore reacts slowly to daily fluctuations in RH. Since F100 is much more responsive to daily moisture fluctuations, the combination of the two creates a single index that represents our best chance of forecasting large fires, if an ignition occurs.**